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ABSTRACT

Solving methodological problems of language instruction lies in analyzing the dynamics of verbal behavior and the process of language acquisition. The glossodynamic model of language learning is based on the recognition that language behavior is basically a stratificational and hierarchical system of dynamic structures. An integrated view of language behavior operates on three levels: personality structure and dynamics in a contextual perspective, cognitive processes, and operant conditionings. The "deep structure" of language behavior lies in a hierarchical structure of three operational levels in human behavior and learning. The first is the tactic level, with its ordering of language acts through decoding and encoding, neural cortical/peripheral coordination, and verbal feedback. The strategic level includes rule-making, selective, programing and conscious self-regulatory processes. The ego-dynamic level includes existential experience, perception, attitudes and self-awareness. Constituent elements of language behavior as communication include: source of the message, transmitter (the voice or the hand and arm), situation, message, channel, receiver and destination. The glossomathetic model of language learning-teaching involves assimilating language learning units by a process of cognition, practice and control. A modular concept of teaching, where the order of these phases is interchangeable and the instructional roles are reversible, is recommended. (CHK)

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A psycholinguistic definition of the « Glossodynamic Model »* of language behaviour and language learning

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0. Premise

0.1. Today widespread dissatisfaction is felt among language teachers and methodologists about current methods of foreign language teaching. The 'audiolingual approach' has been severely criticized and pattern practice is being superseded by or integrated with a rationalistic or 'cognitive-code theory' aiming at mastery of internal rules rather than at formation of habits. The historical pendulum seems to be swinging back again to a recovery of whatever was acceptable in the formal approach characterized by knowledge of grammar, although the newly accepted notion of grammar is considerably different from the traditional view of it.

To my mind, however, the solution of this methodological issue cannot consist in unburying old theories and assigning them new labels, but in furnishing first of all a deeper and more comprehensive analysis of the dynamics of verbal behaviour and of the process of language acquisition. Many of the present shortcomings in the application of existing instructional models seem to derive from lack of an integrated and sufficiently flexible

* The term *Glossodynamics* was used, perhaps for the first time, by A.A. Roback to mean a general *dynamic psychology* of language which would take account of internal, especially motivational, variables. (Cf. A.A. Roback, «Glossodynamics and the present status of psycholinguistics», in A.A. Roback (ed.), *Present-day psychology*. New York: Philosophical Library, 1955, pp. 897-912). Here the term is restricted to signify a multi-level operational model of language behaviour.

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teaching-learning model of language behaviour and language learning.

An inadequate methodological basis is evident in the direction of both technological implementation and research in language teaching. The application of the new instructional technologies lacks consistency and purpose because they deplorably emphasize passive indoctrination instead of stimulating active personal learning experience¹.

On the other hand, research on language teaching methods and techniques is devoid of clarity and justification because the scope, the general framework, and the actual variables of the language-learning process are ill-defined or not duly focused².

0.2. The solution that I wish to submit to earnest examination consists in the development of a synthetic approach to language learning, i.e. of the *glossodynamic model*.

The starting point of the 'glossodynamic model' (GDM) of language learning is the recognition that language behaviour, far from being a linear series of one-level operations, is basically a *stratificational and hierarchical system of dynamic structures*.

Such a unified multiplicity implies the simultaneous and overlapping involvement of very different operational levels. I believe that language behaviour is a very important specification of personality dynamics viewed in concrete contextual organization and as such it cannot be reduced to a mere system of verbal habits or even to a system of cognitive processes³. Such a reduc-

¹ Such a lack of rationale appears from several critical writings. Among others a significant criticism can be found in: *To Improve Learning: A Report to the President and the Congress of the United States by the Commission on Instructional Technology*. Washington, D.C.: U.S. Gov. Printing Office, 1970; C.R. Carpenter, « The Commission on Instructional Technology and Its Report », *Educational Broadcasting Review*, vol. 4, no. 4, 1970, 3-10; H. Dieuzeide, « Educational technology and the development of education », *Educational Broadcasting Review*, vol. 5, no. 4, 1971.

² Confusion of ideas and issues continues in the realm of language teaching research. One recent voice of criticism echoes in E.S. Freedman, « The road from Pennsylvania: where next in language experimentation? », *Audiovisual Language Journal*, 1971, 9 (1), 33-38.

³ I am in full accord with T. Slama-Cazacu's thesis « de l'importance de l'« ensemble » dans les phénomènes de langage ». (T. Slama-Cazacu, *Langage et contexte*. 's-Gravenhage, Mouton, 1961, p. 10). It is more and more necessary to view « l'étude du langage comme phénomène réel et total, dans ses manifestations vivantes, en rapport avec l'homme et déterminées par les circonstances où se trouve celui-ci ». (Ibidem, p. 15). More explicitly: « La seule valorification qui puisse être acceptée serait de considérer comme un *summmum* expressif le langage « total », c'est-à-dire le langage qui réunit la richesse de symbolisation et l'intonation du langage articulé, à la simplicité et à la forme succincte du langage corporel, à la variété du langage extra-corporel, aux corrélés situationnels et à l'auxiliaire des diverses manifestations affectives ». (Ibidem, p. 43).

tion would be tantamount to admitting the possibility of 'speaking' without a 'speaker' or of 'hearing' without a 'hearer', in other words of acts without a pertinent and competent actor. Therefore, language behaviour, like all behaviour, postulates an adequate concept of 'personality' as the ultimate root and source of incoming and outgoing processes. A comprehensive view of personality structure does not do away with but rather implies the 'intra-action' and 'inter-action' of cognitions and habits.

This integrated view of language behaviour and learning includes the co-existence and co-operation of three distinct levels, namely: (a) personality structure and dynamics in a « contextual » perspective, (b) cognitive processes, and (c) operant conditionings. These three variables are in essence mutually dependent and integrated on a dynamic basis (which means that integration is not a state but a continuous process, a dynamic equilibrium, never entirely achieved, as is typically evident in the case of individual bilingualism).

The assembling of three different levels does not entail a mere juxtaposition of three theories; rather, all three levels are the essential constituents of one unified theory of language behaviour and language learning.

At this point I should make it clear that it is not the aim of this paper to explain and justify the bases of my theory but simply to outline its distinctive features and indicate its possible applications⁴

⁴ I must refer for a more detailed presentation of my personalogical views to other writings, chiefly: R. Titone, *Psicolinguistica applicata*. Roma: Armando, 1970, ch. 4 (English translation: *Applied Psycholinguistics*, to be published by Longman, London), and R. Titone, « Il mio credo psicolinguistico » (My psycholinguistic creed), to appear in *Rassegna Italiana di Linguistica Applicata* (Rome, Italy). My views are closely related to those recently expressed by « humanistic psychologists ». Just to recall some of the characteristic features of « humanistic psychology » may I quote from Floyd W. Matson: « This recognition of *man-in-person*, as opposed to *man-in-general*, goes to the heart of the difference between humanistic psychology, in any of its forms or schools, and scientific psychologies such as behaviorism. (...) This emphasis upon the person, upon the individual in his wholeness and uniqueness, is a central feature of the « psychology of humanism ». But there is an important corollary without which this personalistic emphasis would be inadequate and distorted. That corollary is the recognition, to use a phrase of Rank, that « the self needs the other ». » (F.W. Matson, « Humanistic theory: the third revolution in psychology », *The Humanist*, March-April, 1971, p. 9). The names of the spokesmen of psychological humanism are well known: Martin Buber and his philosophy of dialogue, Ludwig Binswanger's, Viktor Frankl's and Rollo May's existential psychology, Abraham Maslow, Gordon Allport, Carl Rogers, Erich Fromm, Henry A. Murray, Joseph Nuttin, etc. I am especially indebted to the Belgian Nuttin's idea of the structure of personality. (Cr. J. Nuttin, *La structure de la personnalité*. Paris: Presses Universitaires de France, 1968, and *Tâche, réussite et échec*.

I will present, therefore, a basic description of the constituent structures of the 'Glossodynamic Model' and then a logically related theory of language teaching, i.e. the 'Glossomathetic Theory' (from GDM — to GMT).

1. *An integrated analysis of language behaviour and language learning (the GLOSSODYNAMIC MODEL)*

1.1. The 'deep structure' of language behaviour:

Communicating and the ability to communicate verbally are surface aspects rooted upon profound layers of the individual's personality. The verified existence of such layers disproves the validity of the Chomskyan dichotomy of competence and performance⁵. In other words, it is indispensable to postulate a hierarchical structure of operational levels in human behaviour and learning in order to account for all types and tokens of language events⁶.

The three levels following seem to have sufficient explanatory power for our purpose, viz.:

I. The TACTIC LEVEL⁷. It is the appropriate ordering of each single language act with respect to all verbal antecedents and

Théorie de la conduite humaine. Louvain: Publications Universitaires, 1953, 1961, Itai. transl. 1964).

⁵ N. Chomsky, *Aspects of the theory of syntax*. Cambridge, Mass.: MIT, 1965 p. 3 and *passim*. The Chomskyan dichotomy shows numerous faults among which: (a) a sterilely abstract and generic view of language devoid of its physical, psychological, social, cultural constraints and correlates and of its evolutionary features; (b) an over-rationalistic concept of language which ignores its motivational, imaginal, and emotional functions (a theory of language as a code, not of speech as behaviour); (c) an undue reduction of linguistic and psycholinguistic study to the analysis of competence as heterogeneous to performance; (d) an unjustified reduction of linguistic competence to the sphere of grammar to the oblivion of semantic processes as intrinsic to verbal symbolization (cf. W.L. Chafe, *Meaning and the structure of language*. Chicago: University of Chicago Press, 1970); (e) ignorance of the complex hierarchical articulation of the processes intrinsic to competence, the latter to be seen as linguistic «strategy» (see below 1.1/II).

⁶ The present model should not be confused with the «cybernetic model» which shows a seeming resemblance to the Author's, as laid down in Miller G.A., Galanter E., and Pribram K., *Plans and the structure of behavior*. New York: Henry Holt & Co., 1960.

⁷ The terms «strategy» and «tactics» are taken here in analogy with military parlance. «In military usage, a distinction is made between STRATEGY and TACTICS. STRATEGY is the utilization, during both peace and war, of all of a nation's forces, through large-scale, long-range plan-

consequents. 'Ordering' is seen here as the actual result of language programming, namely as the finished product or concrete verbal performance. The following, therefore, can be considered as tactical operations:

- 1) Decoding and encoding performance. Obviously listening and speaking, or reading and writing, presuppose the acquisition or formation of sets of specific verbal habits, i.e. habits related to:
 - a) auditory/visual input (perceptual habits),
 - b) articulatory/graphic output (motor habits).

- 2) Neural cortical/peripheral co-ordination and integration. Outward language performance presupposes the correct and satisfactory functioning of neural endings and cerebral centres presiding over both perception and articulation.

- 3) Verbal feed-back. Language behaviour as a self-regulatory system is endowed with self-control devices and mechanisms which connect input and output flows uninterruptedly. Feed-back is the very basis of tactical co-ordination.

II. The STRATEGIC LEVEL. The ordered nature of single language performances requires the action of 'ordering' or programming mechanisms which are not directly observable but strictly 'mental' in their nature. The mind of the speaker/hearer is responsible for the meaningfulness and grammaticality of each speech act: Tactics, therefore, presupposes strategy. Strategic operations would include:

- 1) Rule-making processes. The impact of cognition upon empirical language data takes the forms of inductive generalization and of categorization. Phonological, morphological, syntactic, and lexico-semantic rules are not the result of mere induction from sets of language instances but the internal elaboration of language data as raw materials on the basis of mental schemata and categories. This explanation goes counter both to the empiricistic view (Skinner) and the rationalistic-innatist hypothesis (Chomsky): it is basically a dualistic concept which synthesizes experience and conceptualization.

- 2) Selective processes. The verbal act implies a selection of distinct molecular elements (sememes + phonemes + morphemes + phrases + sentences) which go to make up discourse. They are the building blocks of speech constructs.

- 3) Programming processes. The ordering of molecular ele-

ing and development, to ensure security and victory. TACTICS deals with the use and deployment of troops in actual combat». *The Random House Dictionary of the English Language*: v. STRATEGY.

ments into molar structures requires definite programming mechanisms capable of building larger units of speech. Thus discourse construction, the choice of stylistic variants, and more particularly adjustment of each speech act to specific types of situation (contextualization) are typical programming operations, designed to give order, unity, and purpose (significance) to verbal encoding in actual instances of communication between humans.

4) Conscious self-regulatory processes (cognitive feed-back). Proprioceptive and control mechanisms are reflected principally on a conscious level in the human communicator. Here the speaker/hearer becomes aware (or is at least virtually aware) of what goes on in the flow of speech and how language works. He is therefore capable also of self-correction and self-criticism.

III. The EGO-DYNAMIC LEVEL. All psychological and linguistic activities ultimately stem from and flow back to the self of the communicating person. The subject of responsibility, the centre of accountability in human behaviour is the individual *self* (or the 'ego', not in the psychoanalytic sense only). To think that a behavioural model can be complete by simply restricting itself to a cybernetic structure (tactics + strategy) is to posit an acephalous organism, a beheaded body. In *human* communication the cybernetic concept needs to be subsumed into a personological concept. It is indispensable, therefore, to admit a conscious, directing and unifying agent, the individual speaker's self operating on a higher level and controlling all subordinate activities (tactics and strategy).

The channels of the ego's dynamics are manifold. The following list is only a tentative scheme that certainly needs further articulation and development.

1) The existential experience of the speaker/hearer. Personal experience is the very stuff and marrow of expression whether verbal or iconic or other. The 'whats', the 'hows', and 'wherefores' of life are reflected, although in diverse fashion, in the content and form of human language. This is true with the poet no less than with the man-in-the-street.

2) World-perception (*Weltansicht*). The individual's immediate outlook on reality as well as his ultimate view of life and the world — his philosophy of life — determine to varying extents his style of expression. There is a language or 'speaking policy', flexibly adjusted to the varying circumstances of life situations, which characterizes each individual. To speak or not to speak, to speak thus or not thus, to listen or not to listen—are parts of a behavioural policy dependent on the way life and each life instance are concretely envisaged.

3) Attitudes. Personal, socio-cultural, linguistic attitudes, as cognitive-affective sets, may regard both the substantial content of expression and the reaction or standing of the receiver. A message is chiefly a stimulus and response conditioned by the affective tones of its cognitive content. Perhaps in scientific or technical expertise only may attitudes be kept aside or shoved off.

4) Affective components. Feelings and emotions are rarely or only seemingly absent from verbal expression. At times they are primary connotators as in poetry. In many cases, if latent, they can be rather easily detected. In particular instances language sounds can carry a symbolic value or emotional appeal, of which Rimbaud among others was a great master.

5) Unconscious/subconscious sources of verbal messages. Depth psychology can bring powerful illustrations to this point. From Freudian psychoanalysis to existential analysis there is abundant evidence of how deeply speech can mirror the buried ghosts of the human soul no matter how dark such a mirror sometimes may be.

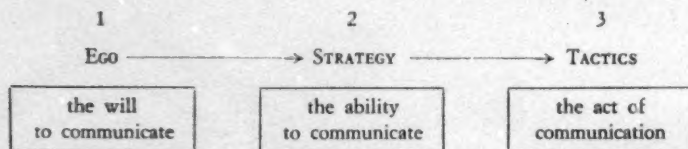
6) Communicative intentions, volitions, and decisions. Communication takes place only when awareness of speech conditions is followed by the intention to speak (*intentio loquendi*) and this finally by the decision to speak. Conative and decisional processes affect the 'all or none', the 'why', the 'what', and 'how' of actual communication. This is the final step as internal antecedent to the speech act, before the incarnation of thought into words.

But over all these processes hovers one distinctly human state:

7) Linguistic self-awareness. The human speaker/hearer is conscious of his self as a communicating agent: («*Loquor ergo sum*»: I speak, therefore I exist). Linguistic competence to the highest degree is equal to the ability of total self-perception and self-control of the verbal actor. This is the summit of 'ego-dynamics'. But it should be clearly pointed out to this respect that linguistic self-awareness is not to be identified with self-centred or narcissistic 'monologism'. Soliloquy or monologues are not the norm of human speech. Since communicating implies inter-personal contact, linguistic self-awareness is essentially 'dyadic consciousness', that is the perception of one's verbal interactions affecting people and the world.

This last remark brings me to the necessity of underlining the point that my personological concept is pivoted on the idea of 'open personality', ready for and capable of vital exchanges, giving and taking, communicative and interactive. Accordingly all the states and processes belonging on the ego-dynamic level are both centripetal and centrifugal, afferent and efferent, finalized

to a constant search for equilibrium between the ego and the world¹. To sum up the essential features of the GDM, one could visualize the genetic order of language acquisition as following these steps:



1.2. The 'surface structure' of language behaviour and language learning:

If we visualize the deep sources of linguistic behaviour as stratified from bottom to surface, we can lay ego-dynamics on the lowest layer, then next strategy, and last, close to the surface, tactics. The performance of communication as a surface process stems immediately from the tactical level; it is in fact the actualization or prolongation of the total of tactical operations. Let us define a few concepts relative to the surface aspects of language behaviour.

1.2.1. Language mastery can be defined as the '*acquired ability to symbolize, to express, and to communicate experience by means of a system of verbal symbols*'. Obviously I start from the assumption that speech is characterized by three intrinsic functions, viz. symbolization, expression, and communication. These are not separate functions, but rather mutual implications, all three being constantly actualized in every act of speech although with varying emphasis. Indeed symbolization is a class of functions including as a rule expression and communication. On the other hand, communication (objective transmission) includes expression (subjective manifestation)². Consequently this specific ability, or set of abilities, should be the target of language learning.

¹ The idea of CONTEXT as basic to language as communication is thoroughly developed by T. Slama-Cazacu (*op. cit.*). « Contexts » are « les ensembles généraux, significatifs pour le langage » (*Langage et contexte, cit.*, p. 209). Context is much more than linguistic environment or the communicative situation. « Il n'y a qu'un seul contexte réel: c'est la situation totale, qui ne comprend pas seulement tous les ensembles linguistiques, mais aussi toutes les coordonnées générales d'une situation. Le contexte est constitué par tous les moyens — linguistiques ou extra-linguistiques — d'expression (mots, gestes etc.), mais aussi détermine le sens », (*Ibidem*, p. 216).

² Cf. R. Titone, *Psicolinguistica applicata*, cit., ch. 3 (« The functions of speech »).

1.2.2. However, communication remains the dominant function of language behaviour. Therefore, a consideration of the nature of such a target boils down essentially to the analysis of the constituent elements of *language behaviour as communication* and of *language learning as learning to communicate*. Suffice it to mention these elements very rapidly, as they are well known from psycholinguistic literature.

1) *Source*: the message is remotely dependent on the existence in the mind of the speaker of cognitive/affective sets and intentional/decisional operations (See 1.1/III), and more proximately on the operation of neural/motor channels controlling speech articulation.

2) *Transmitter*: The voice production apparatus makes speaking possible, while certain hand-arm muscular co-ordinations make writing possible.

3) *Situation*: Linguistic output is subject to certain constraints like: context-perception (the type of message construction is defined by the structure of a particular situational context); verbal responsivity (the use of words instead of other signals is demanded by certain features peculiar to the communication situation); verbal pertinency (the choice of words and structures must conform to the demands of a concrete situation).

4) *Message*: This is a verbal construct resulting from the selection of definite signs out of a system of signs according to syntactic, semantic, and pragmatic criteria.

(C.W. Morris' semiotic model). The message, therefore, is a ratio relating

$$\left\{ \begin{array}{l} \text{'a system of signs as types'}; \text{ i/e.} \\ \text{'a selection of signs as tokens'} \end{array} \right. M = \frac{Ss/tp}{ss/tk}$$

5) *Channel*: The *milieu* and medium where and whereby sound-waves or light-waves are transmitted: stimuli in the form of signals.

6) *Receiver*: The hearing apparatus makes listening and aural comprehension possible, while the visual apparatus makes reading and graphic comprehension possible.

7) *Destination*: The signal-stimuli are conveyed to the brain of the receptive communicator through neural-sensory operations; the message is accepted, and finally interpreted on the basis of cognitive-affective sets.

The act of communication takes the form of an automatic chain of events due to the fact that the total process results from the co-ordination and integration of all intermediate steps and

centres into a compact unified behavioural system, i.e. a linguistically operating structure. External co-ordination of vocal elements on the tactic level issues from the internal co-ordination of programming rules on the strategic level, and finally both levels are unified into vertical control exerted by the ego.

How does this final cumulative integration come about?

This will be the object of my next remarks.

2. *A suggested model of language learning-teaching (the GLOSSOMATHETIC MODEL)*

The integration of 'ego→strategy→tactics' is dependent on a process of assimilation which tends to incorporate a language behavioural system into the communicator's personality (GLOSSOMATHETIC PROCESS)¹⁰. This assimilation process can be described as a series of phases or learning units, each constituted by a set of well-defined activities aiming at the fixation of specific verbal habits or rules. Since such units necessarily include rather large portions of content and usually extend over sufficiently long periods of time, we can name them MACROMATHEMES (a MATHEME is a minimum learning unit).

Which are the basic MACROMATHEMES within a language learning programme? There is no apriori criterion for defining the boundaries of such large units: their number and extension depend on the kind of subject-matter, on the level of learning, on the student's rhythm, etc. For instance, learning the entire system of vowel phonemes of the French language may constitute a significant MACROMATHEME, especially if such phonemes are to be learnt not in isolation but within real language structures.

On the contrary, we can define the essential steps constituting each single MACROMATHEME. These steps are suggested by an integrated psychology of learning, and they may be named MICROMATHEMES. They are defined by significant specific activities of learning, and can by and large be reduced to three: COGNITION→PRACTICE→CONTROL¹¹. Comprehending the nature

¹⁰ «Mathetics» is taken here in its broad etimological meaning (Greek: *mathnōmai*) to indicate the general theory and methodology of learning stemming from interdisciplinary principles. It should not be restricted to Gilbert's «mathetic model» of programmed learning. (Cf. the description of T.F. Gilbert's «mathetic system» by Pennington and Slack in Margulies S. and Eigen L.D., *Applied programmed instruction*. New York: Wiley, 1962).

¹¹ The author's idea of cognitive learning is to a large extent close to the one expressed in J. S. Bruner's writings, esp.: J. S. Bruner, *A study of thinking* (New York: Wiley, 1956, 1967), and *Toward a theory of instruction* (Cambridge, Mass.: Harvard University Press, 1966).

of a task is the initial (inchoative) step of any type of learning; reinforcing the execution of the task by systematic practice is a step leading to 'unconscious' assimilation; while proper feedback or control of each operation leads to conscious assimilation of skills and to final competence. It must be noticed that MOTIVATION is not absent from this scheme; on the contrary motivational factors play a constant, though sometime latent, role throughout the whole process; cognitive operations, exercises and drills, proprioceptive controls are all influenced by needs, drives, interests, affective states, attitudes, in short by the ego's dynamics.

May I then at this point dwell a little while on explaining the meaning and significance of each MICROMATHEME.

2.1. Teaching-learning steps (*MICROMATHEMES*):

Perception and cognition of discourse units (inclusive of phonology, morphology, syntax, lexicon, etc.) are parts of the INCHOATION MICROMATHEME (ImM). This consists of mainly three microphases, viz.: 1) GLOBAL PERCEPTION of a relatively large portion of language discourse which might be presented in the forms of a DIALOGUE, or of a NARRATIVE, or of a DESCRIPTION. The choice of either one of these forms depends on the type of language to be learnt and/or the level of learning of the students concerned. A Dialogue implies a more immediate and lively sort of interaction. A Narrative describes people and actions (time dimension). A simple Description portrays still objects (space dimension). 2) OPERATIONAL ANALYSIS aiming at the active understanding of specific segments of the proposed language unit by means of systematic exploitation of particular lexical and grammatical structures (comprehension exercises). 3) OPERATIONAL SYNTHESIS intended to the reconstruction of a complete discourse unit based on the initial sample (Dialogue/Narrative/Description).

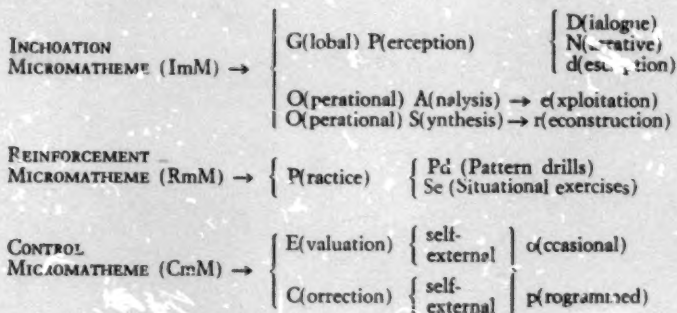
This first phase represents some kind of surface learning, let us say, metaphorically, something like a first coat of paint. The next phase, therefore must aim at strengthening initial learning so as to produce real assimilation. The second then is the REINFORCEMENT MICROMATHEME, where the term 'reinforcement' is taken in its largest sense to indicate stable operational organization brought about by increased motivation and repeated use. PRACTICE is therefore the key-word in this context. Evidently practice does not mean mere repetition of the same items but intensive and extensive manipulation of language wholes as well as of single items in meaningful contexts and true-life situations.

PATTERN DRILLS are one elementary form of segmented practice, and they aim essentially at refining the mechanical elements of language skills. But, over and above pattern practice,

language learning requires the immersion of the learner in meaningful situations of verbal communication (contextualization) through such attempts at spontaneous verbalization as are the commonly called SITUATIONAL EXERCISES (dramatization, guided and free conversation, group discussion, expansion of dialogues, etc.).

Throughout both the INCHOATION phase and the REINFORCEMENT phase control or linguistic feed-back is constantly exercised by the teacher and the student inasmuch as human learning is self-regulatory by nature. But a maximum of consciousness is and must be attained at a certain point in the process by providing for explicit and systematic CONTROL: the CONTROL MICROMATHEME (CmM). Conscious control can be exercised first through EVALUATION (whether externally produced by the teacher or by some teaching device or, in later stages, by the student himself) and CORRECTION (external and self-correction). Both Evaluation and Correction can be occasional, as certain needs arise, or programmed (inserted in some definite steps of the instructional process and material).

The whole series of phases and steps can be outlined as follows:¹²



The sequential order of the three MICROMATHEMES is not so invariable as it might appear from the foregoing outline. Although from a formal point of view — that is from the viewpoint of abstract consideration of process sequentiality — the development of learning would proceed from inchoation through reinforcement to control, in actual fact the order may change due to various instructional conditions. This remark leads me to define some interesting aspects of the Glossomathetic Process in terms of 'modularity'.

¹² The outlined sequence can become the base of a general « teaching algorithm ».

2.2. The concept of 'modular teaching':

We can define 'modular teaching' as any instructional process characterized by *cyclical reversibility*¹³ and *spiral development*.

a) Teaching is modular when it is characterized by reversibility and interchangeability of instructional phases. This means that the position of each micromatheme can be changed or reversed starting from the 3rd (CmM) or the 2nd (RmM) according to particular needs. (If, in other words, the initial language portion is already mastered, the teacher may either pass to Control or to Reinforcement. Furthermore, it may be useful or necessary to go back and forth along the three basic phases in order to clarify, re-organize, strengthen, and expand the essential constituents of language competence).

b) Teaching is modular if instructional roles are reversible. The teacher offers initiating stimuli to the learner's responsiveness; but he becomes in turn a respondent by taking up contingently the role of the learner, and so forth. Both the teacher and the student are alternately stimulators and reactors.

c) Teaching is modular if each micromatheme is co-present while each of the others is being developed. Obviously, while e.g. the Inchoation Micromatheme is being fully developed, the others are involved to a minor or varying degree only. Development of each phase takes place in a spiral manner and is virtually endless ('open-ended learning').

d) The cyclical nature of modular teaching is an overall characteristic of this process inasmuch as phases and roles are not linearly juxtaposed one onto the other but unfold one out of the other after some sort of generation. Each micromatheme is more like a germinal molecule urging toward greater development ('cyclical/spiral process'), not like a fenced-up monad or a completely self-contained unit. Learning is therefore a developmental process working through differentiation and integration; it is in a profound sense a *biological continuum*; it is not an accumulation of disjointed building blocks.

I believe that a modular concept of teaching such as involved in the Glossomathetic Model and, more radically, a Glosso-

¹³ The concept of «reversibility» could be logically related to Pask's «adaptive teaching» model and especially to Storulow's «idiomorphic programming». (Cf. Pask G., «Adaptive teaching systems and a minimal cybernetic model for designing them», *Cybernetica*, 1964, 2, pp. 126 ff.; and L.M. Storulow, «A model and cybernetic system for research on the teaching-learning process», *Programmed Learning*, 1956, 3, pp. 138-157).

dynamic Model of language behaviour and language learning are capable of furnishing extensive articulation and at the same time a high degree of intensiveness in language teaching. Its integrative character and its flexibility seem to guarantee for maximum effectiveness, as research in a few Italian schools has confirmed. Moreover, the Glossomathetic Model can be fruitfully applied whenever technological aids (A-V techniques, closed-circuit TV, language laboratories, programmed instruction, etc.) are introduced into teaching. And finally, as a couple of research projects are showing, this operational model can usefully implement both elementary programmes of foreign language teaching and advanced instruction in the native language.